

SEQUENCE LISTING

SEQ ID NO:1

5 Nucleotide sequence for HCMV Toledo US28 (same sequence as AU4.1)

ATGACACCGACGACGACGACCGCGGAACCTCACGACGGAGTTTGACTACGATGAA
GCCGCGACTCCTTGTGTTTTACCGACGTGCTTAATCAGTCAAAGCCGGTTACGT
TGTTTCTGTACGGCGTTGTCTTTCTGTTCCGTTCCATCGGCAACTTCTTGGTGATC
TTCACCATCACCTGGCGACGTGCGATTCAATGCTCCGGCGATGTTTACTTTATCA
10 ACCTCGCGGCCCGCGATTGCTTTTCGTTTGTACACTACCTCTGTGGATGCAATAC
CTCCTAGATCACAACCTCCCTAGCCAGCGTGCCGTGTACGTTACTCACTGCCTGTTT
CTACGTGGCTATGTTTGCCAGTTTGTGTTTATCACGGAGATTGCACTCGATCGCT
ACTACGCTATTGTTTACATGAGATATCGGCCTGTAAACAGGCCTGCCTTTTCAG
TATTTTTTGGTGGATCTTTGCCGTGATCATCGCCATTCCACATTTTATGGTGGTGA
15 CCAAAAAAGACAATCAATGTATGACCGACTACGACTACTTAGAGGTCAGCTACC
CGATCATCCTCAACGTAGAACTCATGCTCGGTGCTTTCGTGATCCCGCTCAGTGT
CATCAGCTACTGCTACTACCGCATTTCAGAATCGTTGCGGTGTCTCAGTCGCGC
CACAAAGGTCGCATTGTACGGGTACTTATAGCGGTCGTGCTTGTCTTTATCATCTT
TTGGCTGCCGTACCACCTAACGCTGTTTGTGGACACGTTAAACTCCTCAAATGG
20 ATCTCCAGCAGCTGCGAGTTCGAAAGATCGCTCAAACGTGCGCTCATCTTGACCG
AGTCGCTCGCCTTTTGTCACTGTTGTCTCAATCCGCTGCTGTACGTCTTCGTGGGC
ACCAAGTTTCGGCAAGAACTGCACTGTCTGCTGGCCGAGTTTCGCCAGCGACTCT
TTTCCGCGATGTATCCTGGTACCACAGCATGAGCTTTTCGCGTCGGAGCTCGCC
GAGCCGAAGAGAGACATCTTCCGACACGCTGTCCGACGAGGTGTGTGCGGTCTC
25 ACAAATTATACCGTAA

SEQ ID NO:2

Amino acid sequence for HCMV Toledo US28 (same sequence as AU4.1)

MTPTTTTAEALTTEFDYDEAATPCVFTDVLNQSKPVTFLYGVVFLFGSIGNFLVIFTIT
30 WRRRIQCSGDVYFINLAAADLLFVCTLPLWMQYLLDHNSLASVPCTLLTACFYVAM
FASLCFITEIALDRYYAIVYMRYRPVKQACLF SIFWWIFAVIIAIPHFMVVTKKDNQC
MTDYDYLEVSYPIILNVELMLGAFVIPLSVISYCYRISRIVAVSQSRHKGRIVRVLIA
VVLVFIIFWLPYHLTLFVDTLKLLKWISSSCEFERSLKRALILTESLAFCHCCLNPLLY

VFVGTKFRQELHCLLAEFRQRLFSRDVSWYHSMFSR RSSPSRRETSSDTLSDEVCRV
SQIIP*

5 SEQ ID NO:3

Nucleotide sequence for HCMV VHL/E US28

ATGACACCGACGACGACGACCGCGGAACCTACGACGGAGTTTGACTACGACGAT
GAAGCGACTCCCTGTGTCCTCACCGACGTGCTTAATCAGTCGAAGCCAGTCACGT
TGTTTCTGTACGGCGTTGTCTTTCTCTTCGGTTCATCGGCAACTTCTTGGTGATCT
10 TCACCATCACCTGGCGACGTGCGATTCAATGTTCCGGCGATGTTTACTTTATCAA
CCTCGCGGCCGCCGATTTGCTTTTCGTTTGTACACTACCTCTGTGGATGCAATACC
TCCTAGATCACAACCTCCCTAGCCAGCGTGCCGTGTACGTTACTCACTGCCTGTTTC
TACGTGGCTATGTTTGCCAGTTTGTGTTTTATCACGGAGATTGCACTCGATCGCTA
CTACGCTATTGTTTACATGAGATATCGGCCTGTAAACAGGCCTGCCTTTTCAGT
15 ATTTTTTGGTGGATCTTTGCCGTGATCATCGCCATTCCACACTTTATGGTGGTGAC
CAAAAAAGACAATCAATGTATGACCGACTACGACTACTTAGAGGTCAGTTACCC
GATCATCCTCAACGTAGAACTCATGCTCGGTGCTTTCGTGATCCCGCTCAGTGTC
ATCAGCTACTGCTACTACCGCATTTCCAGAATCGTTGCGGTGTCTCAGTCGCGCC
ACAAAGGCCGCATTGTACGGGTACTTATAGCGGTCGTGCTTGTCTTTATCATCTTT
20 TGGCTGCCGTACCACCTGACGCTGTTTGTGGACACGTTGAAACTGCTCAAATGGA
TCTCCAGCAGCTGCGAGTTCGAAAAATCACTCAAGCGCGCGCTCATCTTGACCGA
GTCACTCGCCTTTTGTCACTGTTGTCTCAATCCGCTGCTGTACGTCTTCGTGGGCA
CCAAGTTTCGGCAAGAACTGCACTGTCTGCTGGCCGAGTTTCGCCAGCGACTGTT
TTCCCGCGATGTATCCTGGTACCACAGCATGAGCTTTTCGCGTCGGAGCTCGCCG
25 AGCCGAAGAGAGACGTCTTCCGACACGCTGTCCGACGAGGCGTGTGCGGTCTCA
CAAATTATACCGTAA

SEQ ID NO:4

Amino acid sequence for HCMV VHL/E US28

30 MTPTTTTAELTTEFDYDDEATPCVLTDVLNQSKPVTFLYGVVFLFGSIGNFLVIFTIT
WRRRIQCSGDVYFINLAAADLLFVCTLP LWMQYLLDHNSLASVPCTLLTACFYVAM
FASLCFITEIALDRYYAIVYMRYRPVKQACLF SIFWWIFAVIIAIPHFMVVTKKDNQC
MTDYDYLEVSYFIILNVELMLGAFVIPLSVISYCYRISRIVAVSQSRHKGRIVRVLIA
VVLVFIIFWLPYHLTLFVDTLKLLKWISSSCEFEKSLKRALILTESLAFCHCCLNPLLY

VFVGTKFRQELHCLLAEFRQRLFSRDVSWYHSMFSR RSSPSRRETSSDTLSDEACRV
SQIIP*

5 SEQ ID NO:5

Nucleotide sequence for RhUS28.1

ATGAATAACACATCTTGCAACTTCAACGTCCTCAACGCATCGGCACCAAGCC
GATACATAGCTATTGCTATGTACAGCATTGTTATCTGTATCGGGTTGGTTGGAAA
CCTGCTGTTATGCATCGTGTTAGTCAAGAAACGCAAACCTGCGATATTCCAGCGAT
10 GTTTATTTTTTCCACGCCTCTATGGCCGACCTCGTCAGCACTGTCATGCTACCGCT
CTGGCTACATTATGTCCTCAACTTTGCCCAACTCTCTCGAGGAGCCTGTATCAGCT
TTTCGGTGACTTTCTATGTTCCCTTTTCGTTTCAGGCCTGGTTACTCATTTCATCG
CTATGGAGCGATATTCCAACCTAGTATGGATGGCACCCATTAGCGTTAAGACGGC
CTTTAAACACTGCATAGGAACCTGGATCGTATCTGCCTTCGTGGCATCACCTAC
15 TACGCATACAGAACTCACACGACGAACACGAATGCATTCTAGGAACTACACT
TGGCACATTAACGAACCGCTACACACGTGTATGGATGTGGTGATCATAGTATGGA
CCTTTTTGGCCCCAGTACTGGTAACCATTATAGCAAGCGTCAAAATGAGACGAAC
GACCTGGGGCAATACTAGGTTAAACGAAAAGAACAGCGACATTCTTATAGTACT
AGTTGTCATGACAGTGTTCTTTTGGGGACCGTTTAATATCGTGTTGGTTATTGACA
20 ATATTTTACAGAGATACTATGATACCACGAATTGCGATGTAGAAAAGATTAAAC
ATATCATGGCTATGATCTCAGAAGCCATTGTTTATTTTCGCGGTATTACAGCACCT
ATTATTTATGTAGGGATTAGTGGCAGATTTTCGCGAAGAGATTTACTCTCTGTTTA
GACGCCAGCCGTATAACGATTTGGACCCCGATGCCAATCAATTCATGATTGAACT
CACTAGCCAGGGAAGAAGTAGAAATAGAAATGCTAGACAATCGGAAAGCAATG
25 TACCGCAACCAGAAGAATGCTTCTGGTAA

SEQ ID NO:6

Amino acid sequence for RhUS28.1

MNNTSCNFNVTNLNASAPSR YIAIAMYSIVICIGLVGNLLLCIVLVKKRKRLRYSSDVYFF
30 HASMADLVSTVMLPLWLHYVLNFAQLSRGACISFSVTFYVPLFVQAWLLISIAMERY
SNLVWMAPISVKTAFKHCIGTWIVSAFVASPYAYRNSHDEHECILGNYTWHINEPL
HTCMDVVIIVWTFLAPVLVTHIASVKMRRTTWGNTRLNEKNSDILIVLVVMTVFFWG
PFNIVLVIDNILQRYYYDTTNC DVEKIKHIMAMISEAIVYFRGITAPIIYVGISGRFREEIY
SLFRRQPYNDLDPDANQFMIELTSQGRSRNRNARQSES NVPQPEECFW*

SEQ ID NO:7

Nucleotide sequence for RhUS28.2

5 ATGACCAACGCCGGACACTGTCACATAAACGAAAGTCTCGCGTCGTATGGAATC
GCTCCCGCAGCTACCATTACCTTATACAGCATTGCGGGAATCTGCGGTGTCACGG
GAAATCTGTTAATACTTTTGGTTTTGTTACGAGACGCATACACTGGTTTCGCAA
TGACATCTACTATCTCAACATGATCTTTACAGACTTTCTTGTTTTTCATTACATTAC
CCGCCTGGGTTTACTACCTGCTGAATTACACACAACCTCTCACACTATGCCTGCATT
10 GCTCTATCATTTGTTTTTTACGTTTCCATTTTATTCAAGCTGACTTTATGGTAGCA
GTGGCTATCGAGCGTTATCGAAGCCTAGTGAAAAACAAACCCCTTAGCGTAAAA
AAAGCCAGCGTCAGCTGCGCGTGCATCTGGATCATTGTTATTATAGTGTCTTCAC
CATACTACATGTTTAGATCGCAACACGAAACAAATTCTTGCAATTCTAGGAAACTA
CACCTGGCATATGAACAGTCCTTTTCGCACCACAATGGACGCATCCATTAACATT
15 TGGTCTTTTGTCTGTTCCGGCCGTGACGACCTTGTTAATAGCCAGACGAATTTATGT
ATGTACTTCAGGCAACAAAAAATGAACGCCAGAGCCAGTGGTTTGTAGAGGC
CATGGTGATTAGCATGTTATTCTTCGGAGGACTTTTCAACCTGAACATCTTTCGAG
ACATAGTTTCGGACACATCGGAAGACAATAAAGACTGCACATATCTTAAGCAGG
AACACTTTATTTCGCATGGTCGGTGTGGCCCTCGTTTACGGGCGCGCTATATTCAA
20 CCTTTTATGTATATGTGTGTGAGTACCAGATTGCGCCAAGAAATAAAATGTTTG
TTTATGCGAATACCTTATGAAACACTAGATGCAGAACACGCTAAACTCATGGTTA
ATTTAAAAAACAGAAATGCTAATGTACCCGATCCTAAACCTCGTGAATATGAATC
TGTGTTATAG

25 SEQ ID NO:8

Amino acid sequence for RhUS28.2

MTNAGHCHINESLASYGIAPAATITLYSIAGICGVTGNLLILLVLFTRRIHWFANDIYY
LNMIFTDFLVFITLPAWVYLLNYTQLSHYACIALSFVIFYVSIFIQADFMVAVAIERYR
SLVKNKPLSVKKASVSCACIWIIVIVSSPYMFERSQHETNSCILGNYTWHMNSPFRTT
30 MDASINIWSFVVPVAVTTLLIARRIYVCTSGNKKMNARASGLLEAMVISMLFFGGFLN
LNIFRDIVSDTSEDNKDCTYLKQEHFIRMVGVALVYGRAIFNPFMYMCMVSTRLRQEIK
CLFMRIPTYETLDAEHAKLMVNLKNRNANVPDPKPREYESVL*

SEQ ID NO:9

Nucleotide sequence for RhUS28.3

ATGACCAACACTAACAATACGACTTGTCATCTCAACGGAAC TTTCGAAACTTTTA
AAATCACCCGTCAGTAGCCATCAGCGCCTACACTGTACTCGTGGTTATCGGACT
TTTGGGAAACATTGTGCTGCTCAGCGTGCTCGTCGTGAAACGCAAGCTCAAGTTT
5 CCGAATGACATTTACTTTTTCAACGCGTCTTTGGCAGACGTTTTTGCCGTCTGCAT
GTTGCCCCGCCTGGGTAACTATGCACTGGACTCCACACAACCTTAGCAAGTTCTCA
TGTATCACTTTTACGTTTGGTTTTTACGTCTCCCTGTTTCATCCAGGCCTGGATGCT
CATTCTGGTCACCCTGGAGCGATACGGATCTCTAGTCTGGATCGCCCCGATCACC
AGAAACAAAGCCATAGCGAATTGTGTACTCTTTTGGCTTGTTTCCATCTTCTTGGC
10 CGCACCTTACTACTCTTTTAGAAACGAAAGCAACGAACACCAATGCATCATGAG
AAACTATACCTGGAGCGTTGGTGAAACATGGCACATAGCCCTGGATTTCTTAATT
ACGCTCATTACATTTATCATGCCAGTGACTATTGTGTAGCTCTGAGTTTCAAAT
GGCCAGATGGTCAACCTTTGGTTACAGAAACCTCACCAGCAGAACCAGTCTTATC
CTTATTTTGATACTGACAGTAGCAGCAGGGTTCTGGGGACCTTTTCACCTATTTAT
15 GTTTATAGAAAACGTGGCAGGGCAGATTTACCACATTCAAAGGATTGCTGGTA
CTTACAGCTCAGACACTTGTGTAGCTTGATGACCGAAACCCTAGTGTTTCTACGT
TCAGTTTTTAACCCTTATATTTATATGATAATCAGTTACAAGTTTAGGCAGCAGGT
GCGCAGTCTACTCAAGCGTACTCAGTATGATGCTTTGGACACGACTCAGTTAGCA
GAAACTATGCAGCTGAAAGCGAAAGGTGTGCCGGTGTCCGACCCCGCGCCGCAT
20 GACTGCGAATGCTTTTTGTAA

SEQ ID NO:10

Amino acid sequence for RhUS28.3

MTNTNNTTCHLN¹GT FETFKITRPVAISAYTVLVVIGLLGNIVLLSVLVVVRKRLKFPNDI
25 YFFNASLADVFAVCMLPAWVNYALDSTQLSKFSCITFTFGFYVSLFIQAWMLILVTLE
RYGSLVWIAPI²TRNKAIANCVLFWLV³SIFLAAPYYSFRNESNEHQ⁴CIMRNYTWSVGE
TWHIALDFLITLITFIMPVTIVLALSFKMARWSTFGYRNLT⁵SRTSLILILILTVAAGFWG
PFHLMFIENVAGQIYHIQKDCWYLQLRHLC⁶SLMTETLVFLRSVFN⁷PIYMIISYKFR
QQVRSLLKRTQYDALD⁸TTQLAETMQLKAGVPVSDPAPHDCECFL*

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SEQ ID NO:11

Nucleotide sequence for RhU28.4

ATGAATTCGAGCCAGCACAACATAAGCGTGTTTCTCTCCATTGGAGCAGGGCCCG
TCATTACCGGATACACGTGCGTTTTTCTGTTCGGGATTCTGGGACACTTTTACTTG

60
50
40
30
20
10
0

TATTGGAAAAACCATCAGAGACGACACCGGACAAACAGTTTCAGTGATGTTTTAT
TTCGACATCTCATGATCACCGAAGAGGTCTTTACCCTCACCATTCCCGTCTGGGC
GTATCACTTAACACTACGGCAACTTACCGGGCTCGTGGTGCCGAAGTCTCACC
TTCGTTTTTTATCTAACGGTATTCGCTCGTGCCTTCTTTACCTGCTCCTCATCTGG
5 GACCGATACAGCGTAATCATCTGCAGACACCCTCTCCCCGTTAATCTGAACTACA
GTCAGGTCATAGGCCTGTCTGTCTGGCTGGTTGCCGTACTGTCAGCATCACCGTT
CTCCATTTTTTAACGGAAGTGTGAAACAATGCCTGGGCAACATGGGCAGCATACCC
AGCGAATCGTCTGCCGTTCTTAACCTGGAAGTGACCTGTGCTCCTTCTGGTTACC
GCTCATCATGTCCGCTAACTGTTACTACCAAGCAAAACGCCGAGCATCGCCTGAC
10 CAACTCCACGAACCTTACCGATGCAGTTTGCTAATTACCATTATCACAACCTTACG
CTATCGTATGGTTTCCTTTCCATCTCGCTTTACTCATAGACGCCCTGATTAGCATA
AGCCATGTAGAACCCTCTAGCGCTCTCCACTGGGCATCCATTGTCGTTACCTGTA
AATCATTTACATTTGTATATGCGGGCATAAGCCCACTAGTGTATTTACATGCTG
CCCCACCGTACGTCGCGAACTGCTGATGTCTCTACGTCCATTCTTCACCTGGATTT
15 CCAGCAAAACGCGGCGAGGCTACGCTCCGATTAACCAACAACCTTTAAACATCC
CCGACGAGCCGATAGATAACAAGTCACCGCACCTGTAAACGAATAA

SEQ ID NO:12

Amino acid sequence for RhU28.4

20 MNSSQHNISVFLSIGAGPVITGYTCVFLFGILGHFYLYWKNHQRRHRTNSFSDVLF RH
LMITEEVFTLTIPVWAYHLTTHGNLPGSWCRSLTFVFYLTVFARAFFYLLLIWD RYSV
IICRHPLPVNLNYSQVIGLSVWLVAVL SASPFSIFNGSVKQCLGNMG SIPSESSAVLNL
EVHLC SFWLPLIMSANCYYQAKRRASPDQLHELYRCSLLITIITYAIVWFPFHLALLI
DALISISHVEPSSALHWASIVVTCKSFTFVYAGISPLVYFTCCPTVRRELLMSLRPFFT
25 WISSKTRRGYAPIKTQPLNIPDEPIDNKSPHLLNE*

SEQ ID NO:13

Nucleotide sequence for RhUS28.5

30 ATGACTACCACCACAATGAGTGCTACCACGAATTCCAGTACCACGCCTCAAGCA
AGCAGCACCACGATGACAACGAAGACAAGCACTCCTGGCAATACAAC TACTGGC
ACTACGTCCACCCTGACAACGATATCAACAAC TTCTAATGCTACCAGCATAACGT
CTAATTTAAGCACTACCGGAAACCAAAC TGCAACTACCAATGCTACTACCTTCAG
TTCCACATTAACAACATCTACAAATATAAGCAGTACATTTTCGACAGTTTCTACC

SEQ ID NO:15

Nucleotide sequence for HCMV AD169 UL78

5 ATGTCCCCTTCTGTGGAGGAGACTACCTCAGTCACCGAGTCCATCATGTTTCGCTA
TTGTGAGTTTCAAACACATGGGCCCCGTTTGAAGGCTACTCTATGTCGGCCGATCG
CGCCGCCTCGGATCTACTCATCGGCATGTTTCGGCTCCGTTAGCCTGGTCAACCTG
CTGACTATCATCGGTTGCCTCTGGGTGTTGCGTGTTACGCGGCCGCCCGTGTCCGT
GATGATTTTTACTTGGAATCTGGTACTTAGTCAGTTTTTTTTCCATCCTGGCCACCA
10 TGTGTCCAAGGGTATCATGCTGCGTGGCGCTCTAAATCTCAGCCTCTGTCGCTTA
GTGCTCTTTGTCGACGACGTGGGCCTATATTCGACGGCGTTGTTTTTCCTCTTTCT
GATACTGGATCGTCTGTTCGGCCATATCTTACGGCCGTGATCTCTGGCATCATGAG
ACGCGCGAAAACGCCGGCGTGGCGCTCTACGCGGTGCGCTTTGCCTGGGTCTTTT
CCATCGTAGCCGCTGTGCCCACCGCCGCTACGGGTTCCTGGACTACCGTTGGCT
15 AGGCTGTCAGATCCCTATACAGTATGCCGCGGTGGACCTCACCATCAAGATGTGG
TTTTTGCTGGGGGCGCCCATGATCGCCGTACTGGCTAACGTGGTAGAGTTGGCCT
ACAGCGATCGGCGCGACCACGTCTGGTCCTACGTGGGTGCGTGTCTGCACCTTCTA
CGTGACGTGTCTCATGCTGTTTGTGCCCTACTACTGCTTCAGAGTCCTACGCGGTG
TACTGCAGCCCCCTAGCGCGGCCGGCACCGGTTTCGGCATTATGGATTACGTGGA
20 ATTGGCTACGCGTACCCTTCTCACCATGCGTCTTGGCATTCTGCCGCTCTTTATCA
TTGCGTTCTTCTCCCGCGAGCCCACCAAGGATCTGGATGACTCCTTTGATTATCTG
GTCGAGAGATGTCAGCAAAGCTGCCACGGTCATTTCGTACGTTCGGTTGGTGCAGG
CGTTGAAGCGGGCTATGTATAGCGTGGAGCTGGCCGTGTGTTACTTTTCTACGTC
CGTCCGAGACGTCGCCGAGGCGGTGAAAAAGTCCTCCAGCCGTTGTTACGCCGA
25 CGCGACGTCGGCGGCCGTTGTGGTAACGACAACCACGTCGGAGAAAGCCACGTT
GGTGGAGCACGCGGAAGGCATGGCTTCCGAAATGTGTCCTGGGACTACGATCGA
TGTTTCGGCCGAAAGTTCCTCCGTCCTCTGCACCGACGGCGAAAACACCGTCGCG
TCGGACGCGACGGTGACGGCATTATGA

30 SEQ ID NO:16

Amino acid sequence for HCMV AD169 UL78

MSPSVEETTSVTESIMFAIVSFKHMGPFEGYSMSADRAASDLLIGMFGSVSLVNLLTH
GCLWVLRVTRPPVSVMIPTWNLVLSQFFSILATMLSKGIMLRGALNLSLCLVLFVD
DVGLYSTALFFLFLILDRLSAISYGRDLWHHETRENAGVALYAVAFWVLSIVAAPV

TAATGSLDYRWLGCQIPIQYAAVDLTIKMWFLLGAPMIAVLANVVELAYSDDRRDHV
WSYVGRVCTFYVTCLMLFVPYYCFRVLRGVLQPASAAGTGFGIMDYVELATRTLLT
MRLGILPLFIIAFFSREPTKDLDDSFHYLVERCQQSCHGHFVRRLVQALKRAMYSVEL
AVCYFSTSVRDVAEAVKKSSSRCYADATSAAVVVTTTSEKATLVEHAEGMASEMC
5 PGTTIDVSAESSSVLCTDGENTVASDATVTAL*

SEQ ID NO:17

Nucleotide sequence for RhUL78

10 ATGATTACGGAGCGCGTCCTCGCAGGCATCCTCGCGGGCATGACGGCCGCGGGG
AGTTTGGTCATTCTCCTCGCGGTTGTTATGTGGTTGAACATGTTAGATCGCGCTGG
CATGCCAATGGCCGTTGGGCATTACACAGGGAACCTGGTGTGACTCAGGTCATC
TGTATCTTCTCCATGCTGGCGTCTAAAATTGTTGGCATGACGAGTGCGGCCAACA
TGGGCTTCTGCGGCATCGTGGTTTTTCTGGAAGACACTGGCCTCTATGTCACCTCG
15 CTGCTCTTCATGTTTATGATCCTGGATCGCATGGCGGCTTTTCTTAACGGGCGTCT
TTTCTGGAGGCAGCAGACGACGAAGCAGAATCTGAGTACAAGCGTGTACATTAT
TCTGTTTTGCTGGGTGTTGGGAATGGCCGCGGCTGTTCCCAGCGCGGCTGTGGCT
GCACCCAATTCCAGGTGGGAACGCTGCGAAATTCAGTGTCAATATGCCGCAATCG
ACATGATTGTGAAGCTCTGGTTTGTGCTGTTGGCACCCGTCGTGCTGATTATGGCT
20 GTGATCATTCAATCTTCCTATCATCGTGATCGGGAGAGGATCTGGTACTATGCCA
GACGTGTGTTTCATGTTCTACACGGCCTGCTTTGTCATGATGGTGCCTTATTACTTC
GTCAGAGTCATGCTGAGCGACTTTGCTTTGGTTGATATAAAAACAAAAACGGCG
AACAGCGACGGTTGTGATTTCGACATTTCTTGATTATCTGAACATGTTCACTCACG
TGATTTACAGTTTTAAGTTGGTGGTGGTTTGGCTTTGTTTCATTGTCCTGTTTTGCTCCA
25 TAAACCCGATGGAAACGCTGGAAGAATGCTTGGAGAGGGCCGATGCTGAGAGGC
AAAGTCGGTCAGAAGCATCCCAGGGTGAAAGGAGGCTGCCAATCAACACATGCT
GTATAAAGTTGATTGAATTGATAAAGCAGTATGTAAGCACTCTCTCTAAAGCCAC
GAGGGACAATTCTGGCGAAAGGGCCAATTTGCCAGAGAATGCTGAAGATATTGG
AACAACCTGGCAGTGATCAGCTACCGACTGAGGTCACCGTGACCCCAAATTCATC
30 GGCTGTGTTTAGCACTGGAGGAACGGTGTCTCCAGTCTAA

SEQ ID NO:18

Amino acid sequence for RhUL78

MITERVLAGILAGMTAAGSLVILLAVVMWLNMLDRAGMPMAVGHYTGNLVLTQVI
 CIFSMLASKIVGMTSAANMGFCGIVVFLEDTGLYVTSLLFMFMILDRMAAFLNGRLF
 WRQQTTKQNLSTSVYIILFCWVLGMAAAVPSAAVAAPNSRWERCEIPVSYAAIDMIV
 KLWVLLAPVVLIMAVIIQSSYHRDRERIWYYARRVFMFYTACFVMMVPYYFVRVM
 5 LSDFALVDIKTKTANS DGCDSTFLDYLNMFTHVIYSFKLVVFALFIVLFCSINPMETLE
 ECLERADAERQSRSEASQGERRLPINTCCIKLIELIKQYVSTLSKATRDNSGERANLPE
 NAEDIGTTGSDQLPTEVTVTPNSSAVFSTGGTVSPV*

10 SEQ ID NO:19

Nucleotide sequence for HCMV AD169 UL33

ATGACAGGGCCGCTATTCGCCATTCGAACCACCGAAGCCGTACTCAACACATTCA
 TCATCTTCGTGGGCGGTCCACTTAACGCCATAGTGTTGATCACGCAGCTGCTCAC
 GAATCGCGTGCTTGGCTATTCGACGCCCACCATTACATGACCAACCTCTACTCT
 15 ACTAATTTTCTCACGCTTACTGTGCTACCCTTTATCGTACTCAGCAACCAGTGGCT
 GTTGCCGGCCGGCGGTGGCCTCGTGTAATTTCTATCGGTGATCTACTACTCAAGC
 TGCACAGTGGGCTTTGCCACCGTAGCTCTGATCGCCGCCGATCGTTATCGCGTCC
 TTCATAAACGAACATACGCACGCCAATCATACCGTTCAACCTATATGATTTTGCT
 ATTGACATGGCTCGCTGGACTAATTTTTTCCGTGCCCGCAGCTGTTTACACCACG
 20 GTGGTGATGCATCACGATGCCAACGATACCAATAATACTAATGGGCACGCCACC
 TGTGTACTGTACTTCGTAGCTGAAGAAGTGACACACAGTGCTGCTTTTCGTGGAAAG
 TGCTGCTGACGATGGTATGGGGTGCCGCACCCGTGATAATGATGACGTGGTTCTA
 CGCATTCTTCTACTCAACCGTACAGCGCACGTACAGAAACAAAGGAGTCGTACC
 TTAACCTTTGTTAGCGTGCTACTCATCTCCTTCGTGGCGCTACAACTCCCTACGT
 25 CTCTCTCATGATCTTCAACAGTTATGCCACAACCGCCTGGCCCATGCAGTGTGAA
 CACCTCACACTGCGACGCACCATTGGCACGCTGGCGCGTGTGGTGCCCCACCTAC
 ACTGCCTCATTAATCCCATCCTGTACGCGCTGCTGGGTCATGATTTTCTGCAACGC
 ATGCGGCAGTGTTTCCGCGGTGAGTTGCTGGACCGCCGCGCTTTCCTGAGATCGC
 AGCAGAATCAGCGAGCTACAGCGGAGACAAATCTAGCGGCTGGCAACAATTAC
 30 AATCAGTGGCTACGTCATTAGACACCAATAGCAAAAACCTACAATCAGCACGCCA
 AACGCAGCGTGCTTTTCAATTTTCCAGCGGTACGTGGAAAGGCGGCCAGAAAA
 CCGCGTCCAACGACACATCCACAAAAATCCCCCATCGACTCTCACAATCGCATCA
 TAACCTCAGCGGGGTATGA

SEQ ID NO:20

Amino acid sequence for HCMV AD169 UL33

MTGPLFAIRTTEAVLNTFIIFVGGPLNAIVLITQLLTNRVLGYSTPTIYMTNLYSTNFLT
5 LTVLPFIVLSNQWLLPAGVASCKFLSVIYYSSCTVGFATVALIAADRYRVLHKRTYAR
QSYRSTYMILLLTWLAGLIFSVPAAVYTTVVMHHDANDTNNTNGHATCVLYFVAEE
VHTVLLSWKVLLTMVWGAAPVIMMTWFYAFFYSTVQRTSQKQRSRTLTFVSVLLIS
FVALQTPYVSLMIFNSYATTAWPMQCEHLTLRRTIGTLARVVPHLHCLINPILYALLG
HDFLQRMQRQCFRGQLLDRRAFLRSQQNQQRATAETNLAAGNNSQSVATSLDTNSKNY
10 NQHAKRSVSFNFPSGTWKGGQKTASNDTSTKIPHRLSQSHHNLSGV*

SEQ ID NO:21

Nucleotide sequence for HCMV AD169 UL33 spliced

ATGGACACCATCATCCACAACCTCGACCCGCAACAACACTCCTCCGCACATCAATG
15 ACACTTGCAACATGACAGGGCCGCTATTCGCCATTCTGAACCACCGAAGCCGTACT
CAACACATTCATCATCTTCGTGGGCGGTCCACTTAACGCCATAGTGTTGATCACG
CAGCTGCTCACGAATCGCGTGCTTGCTATTCGACGCCACCATTACATGACCA
ACCTCTACTCTACTAATTTTCTCACGCTTACTGTGCTACCCTTTATCGTACTCAGC
20 AACCAGTGGCTGTTGCCGGCCGGCGTGCCCTCGTGTAATTTCTATCGGTGATCT
ACTACTCAAGCTGCACAGTGGGCTTTGCCACCGTAGCTCTGATCGCCGCCGATCG
TTATCGCGTCCTTCATAAACGAACATACGCACGCCAATCATAACCGTTCAACCTAT
ATGATTTTGCTATTGACATGGCTCGCTGGACTAATTTTTTCCGTGCCCGCAGCTGT
TTACACCACGGTGGTGATGCATCACGATGCCAACGATACCAATAATACTAATGG
25 GCACGCCACCTGTGTACTGTACTTCGTAGCTGAAGAAGTGCACACAGTGCTGCTT
TCGTGGAAAGTGCTGCTGACGATGGTATGGGGTGCCGCACCCGTGATAATGATG
ACGTGGTTCTACGCATTCTTCTACTCAACCGTACAGCGCACGTCACAGAAACAAA
GGAGTCGTACCTTAACCTTTGTTAGCGTGCTACTCATCTCCTTCGTGGCGCTACAA
ACTCCCTACGTCTCTCTCATGATCTTCAACAGTTATGCCACAACCGCCTGGCCCAT
30 GCAGTGTGAACACCTCACACTGCGACGCACCATTTGGCACGCTGGCGCGTGTGGT
GCCCCACCTACACTGCCTCATTAAATCCCATCCTGTACGCGCTGCTGGGTCATGATT
TTCTGCAACGCATGCGGCAGTGTTTCCGCGGTGAGTTGCTGGACCGCCGCGCTTT
CCTGAGATCGCAGCAGAATCAGCGAGCTACAGCGGAGACAAATCTAGCGGCTGG
CAACAATTCACAATCAGTGGCTACGTCATTAGACACCAATAGCAAAAACCTACAA

TCAGCACGCCAAACGCAGCGTGTCTTTCAATTTTCCCAGCGGTACGTGGAAAGGC
GGCCAGAAAACCGCGTCCAACGACACATCCACAAAAATCCCCCATCGACTCTCA
CAATCGCATCATAACCTCAGCGGGGTATGA

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SEQ ID NO:22

Amino acid sequence for HCMV AD169 UL33 spliced

MDTIIHNSTRNNTPPHINDTCNMTGPLFAIRTTEAVLNTFIIFVGGPLNAIVLITQLLTN
RVLGYSTPTIYMTNLYSTNFLTTLTVLPFIVLSNQWLLPAGVASCKFLSVIYYSSCTVGF
10 ATVALIAADRYRVLHKRTYARQSYRSTYMILLTLWLAGLIFSVPAAVYTTVVMHHD
ANDTNNTNGHATCVLYFVAEEVHTVLLSWKVLLTMVWGAAPVIMMTWIFYAFFYS
TVQRTSQKQRSRTLTFVSVLLISFVALQTPYVSLMIFNSYATTAWPMQCEHLTLRRTI
GTLARVVPHLHCLINPILYALLGHDFLQRMQRQCFRQQLDRRAFLRSQQNQQRATAET
NLAAGNNSQSVATSLDTNSKNYNQHAKRSVSFNFPSGTWKGGQKTASNDTSTKIPH
15 RLSQSHHNLSGV**

SEQ ID NO:23

Nucleotide sequence for RhUL33

20 ATGACCAATCTTTACTCTGCCAATTTTCTCACCTTGATAGTACTTCCTTTTATCGTT
TTAAGCAATCAACACCTTTTACCTGCCAGTGCAGTAACCTGTAAATTTCTCTCCCT
GTTGTACTACTCTAGCTGCAGCGTAGGTTTTGCTACAGTGGCACTGATAGCGGCC
GACCGATACCGAGTGATTCATCGCCGAACCTCAAGCTCGCCAATCCTACCGTAACA
CATATATGATAGTAGGCTTAACGTGGCTCATTGGCTTGATCTGCGCTACCCCCGG
25 GGGGGTCTACACAACCATTTGTAGCTACCGCGATGGGGAAAGTGATGCTCAAAG
ACACAATACTTGCATTATGCACTTTGCGTATGATGAAGTTTACGTCCTCATGGTCT
GGAAACTTCTCATCGTTTTAGTCTGGGGCATAAGTGCCAGTTGTCATGATGAGCTG
GTTTTACGCGTTTTTTTACAATACTGTACAAAGAACAGCCAAAAACAACAACGT
ACGTTGAAATTCGTAAAGGTATTACTCCTGTCATTCATCATCATCCAAACTCCCTA
30 TGTGTCAATCATGATTTTTTAACACGTATGCCACCGTAGGATGGCCGATGGAATGC
GCCGATCTAACTAGACGCCGAGTCATCAACACGTTTTCCCGTCTCGTCCCCAATC
TACATTGCATGGTCAACCCCATCCTCTACGCTCTCATGGGAAATGACTTTGTGTCT
AAAGTGGGCCAATGCTTTCGGGGGGAACCTCACGAACCGTCGAACCTTTCTGCGTT
CCAAGCAACAAGCCCGCAACTCGGACGATGTACCGACAATTGTCAGTCAACAAC

CCGCCACACCCACCATCGTCAATAAGCCCGAAAAAAACCCGCACGTAAAACGCG
GTGTATCTTTTCAGCGTCAGCGCATCTTCCGAACTCGCAGCGGCCAAAAAAGCCAA
AGACAAAGCCAAGCGGCTTTCATGTCCCACCAAACCTACGTCTGACGTGA

5

SEQ ID NO:24

Amino acid sequence for RhUL33

MTNLYSANFLTIVLPFIVLSNQHLLPASAVTCKFLSLLYYSSCSVGFATVALIAADRY
RVIHRRTQARQSYRNTYMIVGLTWLIGLICATPGGVYTTIVAHRDGESDAQRHNTCI
10 MHFAYDEVYVLMVWKLIVLVWGIVPVVMMMSWFYAFFYNTVQRTAKKQQRTLKF
VKVLLLSFIIIQTPYVSIMIFNTYATVGWPMECADLTRRRVINTFSRLVPNLHCMVNPI
LYALMGNDFVSKVGQCFRGELTNRRTFLRSKQQARNSDDVPTIVSQQPATPTIVNKP
EKNPHVKRGVSFSVSASSELAACKKAKDKAKRLSMHQNLRLT*

15

SEQ ID NO:25

Nucleotide sequence for RhUL33 spliced

ATGGCAGTCACTTTACGAGGCGGCAGCCCGATAAACTTTAAACTCATGATTGTCA
GCCACAGAAACCGGAAATTTACGAGATACGGCTGTTTCAGCGTTCTGCTATCCG
20 TCCAGGCGGGTTATGGAAACCATTTCTTACAACCGAACGAGTGAAACTAATTCCA
TTTTGCACATCAACACCACCTGCAATGTGACCGACTCACTGTACGCCGCCAAACT
AGGCGAAGCCCTCGTGAACAGCGCGCTAGCTTTATTCGGTACCCCCCTCAACGCC
ATCGTCCTCGTCACACAGCTATTGGCCAACCGAGTTCATGGATACTCCACCCCGA
TTATCTACATGACCAATCTTTACTCTGCCAATTTTCTCACCTTGATAGTACTTCCTT
25 TTATCGTTTTTAAGCAATCAACACCTTTTACCTGCCAGTGCAGTAACCTGTAAATTT
CTCTCCCTGTTGTACTACTCTAGCTGCAGCGTAGGTTTTGCTACAGTGGCACTGAT
AGCGGCCGACCGATACCGAGTGATTCATCGCCGAACTCAAGCTCGCCAATCCTAC
CGTAACACATATATGATAGTAGGCTTAACGTGGCTCATTGGCTTGATCTGCGCTA
CCCCCGGGGGGTCTACACAACCATTTGTAGCTCACCGCGATGGGGAAAGTGATG
30 CTCAAAGACACAATACTTGCATTATGCACTTTGCGTATGATGAAGTTTACGTCCT
CATGGTCTGGAAACTTCTCATCGTTTTAGTCTGGGGCATAGTGCCAGTTGTCATG
ATGAGCTGGTTTTACGCGTTTTTTTACAATACTGTACAAAGAACAGCCAAAAAAC
AACAACGTACGTTGAAATTCGTAAAGGTATTACTCCTGTCATTCATCATCATCCA
AACTCCCTATGTGTCAATCATGATTTTTTAACACGTATGCCACCGTAGGATGGCCG

ATGGAATGCGCCGATCTAACTAGACGCCGAGTCATCAACACGTTTTCCCGTCTCG
TCCCCAATCTACATTGCATGGTCAACCCCATCCTCTACGCTCTCATGGGAAATGA
CTTTGTGTCTAAAGTGGGCCAATGCTTTCTGGGGGGAACCTCACGAACCGTCGAACT
TTTCTGCGTTCCAAGCAACAAGCCCGCAACTCGGACGATGTACCGACAATTGTCA
5 GTCAACAACCCGCCACACCCACCATCGTCAATAAGCCCGAAAAAAACCCGCACG
TAAAACGCGGTGTATCTTTCAGCGTCAGCGCATCTTCCGAACTCGCAGCGGCCAA
AAAAGCCAAAGACAAAGCCAAGCGGCTTTCATGTCCCACCAAAACCTACGTCT
GACGTGA

10 SEQ ID NO:26

Amino acid sequence for RhUL33 spliced

MAVTLRGGSPINFKLMIVSHRNRKFHEIRLFQRSAIRPGGLWKPFFTTERETNSILHIN
TTCNVTDLSLYAAKLGEALVNSALALFGTPLNAIVLVTQLLANRVHGYSTPIIYMTNL
YSANFLTIVLPFI VLSNQHLLPASAVTCKFLSLLYSSCSVGFATVALIAADRYRVIH
15 RRTQARQSYRNTYMIVGLTWLIGLICATPGGVYTTIVAHRDGESDAQRHNTCIMHFA
YDEVYVLMVWKLIVLVWGIVPVVMMMSWIFYAFFYNTVQRTAKKQQR TLKFVKVL
LLSFIIIQTPYVSIMIFNTYATVGWPMECADLTRRRVINTFSRLVPNLHCMVNPILYAL
MGNDFVSKVGQCFRGELTNRRTFLRSKQQARNSDDVPTIVSQQPATPTIVNKPEKNP
HVKRGVSFSVSASSELA AAKKAKDKAKRLSM SHQNLRLT*

20

SEQ ID NO:27

CGGCCAAGATGTCCCAAGAGGTTCTGACATGAACAATCACTTTTCCGAGATAGAT
GAGTTTGTTAGTGGCATT TACCAGAGAACTATTGGAGTGACGCTCAAGATGAAGC
25 TTCACTGGCCGTATTTTGAACATATTGTTAGATATAGCTAGTAAAGAATCTTCTA
AAGCCATGACGTCTTTCTGACGAAGTTGAATAAATTCTATCTCACCAGTACCCAA
AGGCTGACACTCAGACAAC TTTGCCAAGGCCGTTGCACCCACCATGGCATTCTGA
ATCACAGTAACATCCGTCCGAGAATCGTCACCAAAAACGGTGGCCTCCAAAGTT
CGCAGGTGAGGCCGAGCCTTTACTGGATCTCGGAAGGGATACATGTGTGCTCGCC
30 GAGTGACAGCATTAGCATTAACCTCAA ACTCATCTAAAAGCGATGATAAATCAG
GAATATGATAGCGCAATTCTCGATAGTAGGCCAACCAGAGGACTAATTGGTTGA
ACAGACAGCTCCGTCTGTGCAAAAAC TTTTCGCCGCATTTTCTGAGAATTTTAGG
ATGCTGCTCTAAATCTACGTTCTCTTTAGTCGGCAGGGTCTTTAAAAAGTTAGTG
ATGGCAGTCACTTTACGAGGCGGCAGCCCGATAAACTTTAAACTCATGATTGTCA

